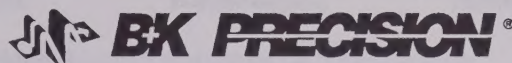


# SERVICING INFORMATION



## MODEL 1541B

# 40-MHz DUAL-TRACE OSCILLOSCOPE

## PARTS LIST

| SCHEMATIC<br>SYMBOL | DESCRIPTION                                                     | B & K-PRECISION<br>PART NO. | SCHEMATIC<br>SYMBOL | DESCRIPTION | B & K-PRECISION<br>PART NO. |
|---------------------|-----------------------------------------------------------------|-----------------------------|---------------------|-------------|-----------------------------|
| <b>FINAL ASSY</b>   |                                                                 |                             |                     |             |                             |
| <b>ELECTRICAL</b>   |                                                                 |                             |                     |             |                             |
| F1                  | 1/2 Amp, 250V, 5 X 20mm Slow Blow Fuse<br>(100 V, 120 V)        | 198-300-0-500               |                     |             |                             |
| F1                  | 0.3 Amp, 250V, 5 X 20mm Slow Blow Fuse<br>(220 V, 230 V, 240 V) | 198-300-0-300               |                     |             |                             |
|                     | Fuse Holder Line Input, Line Select<br>Ass'y                    | 770-032-9-001               |                     |             |                             |
| T602                | Power Transformer                                               | 065-246-9-001               |                     |             |                             |
| VR406/S501          | 10 kΩ, Potentiometer w/switch<br>(VARIABLE, PULL 10 MAG)        | 008-881-9-003               |                     |             |                             |
| VR501               | 10 kΩ Potentiometer (POSITION)                                  | 008-881-9-002               |                     |             |                             |
|                     | 150BYB31 CRT                                                    | 230-039-9-001               |                     |             |                             |
|                     | BNC Connector                                                   | 772-024-9-002               |                     |             |                             |
|                     | CRT Socket PC Board                                             | 303-136-9-001               |                     |             |                             |
|                     | Cable Assembly (J34 to CAL)                                     | 428-182-9-001               |                     |             |                             |
|                     | Cable Assembly (J5A to J5B)                                     | 428-182-9-002               |                     |             |                             |
|                     | Cable Assembly (J15A to J15B)                                   | 428-182-9-003               |                     |             |                             |
|                     | Cable Assembly (J32 to<br>Z Axis INPUT)                         | 428-182-9-004               |                     |             |                             |
|                     | Cable Assembly (J1 to<br>CH 1 OUTPUT)                           | 428-182-9-005               |                     |             |                             |
|                     | Cable Assembly (J13A to J13B<br>and J25A to J25B)               | 428-182-9-006               |                     |             |                             |
|                     | Cable Assembly (J9A to J9B)                                     | 428-182-9-007               |                     |             |                             |
|                     | Cable Assembly (J21A to J21B)                                   | 428-182-9-008               |                     |             |                             |
|                     | Cable Assembly (CRT to GND)                                     | 428-182-9-009               |                     |             |                             |
|                     | Cable Assembly (Ground)                                         | 428-182-9-010               |                     |             |                             |
|                     | Cable Assembly (J16 to POS.)                                    | 428-182-9-011               |                     |             |                             |
|                     | Cable Assembly (J10 to EXT.)                                    | 428-182-9-012               |                     |             |                             |
|                     | Cable Assembly (J18 to CRT)                                     | 428-182-9-013               |                     |             |                             |
|                     | Cable Assembly (J19 to CRT)                                     | 428-182-9-014               |                     |             |                             |
|                     | Cable Assembly, Twin Lead<br>(J6 to CRT and J7 to CRT)          | 428-182-9-015               |                     |             |                             |
|                     | Cable Assembly (J31 to CRT)                                     | 428-182-9-016               |                     |             |                             |
|                     | Cable Assembly (J30 to CRT)                                     | 428-182-9-017               |                     |             |                             |
|                     | Cable Assembly (J11A to J11B)                                   | 428-182-9-020               |                     |             |                             |
|                     | Cable Assembly (J2A to J2B<br>and J4A to J4B)                   | 428-182-9-021               |                     |             |                             |
|                     | Cable Assembly (J12A to J12B)                                   | 428-182-9-022               |                     |             |                             |
|                     | Cable Assembly (J28A to J28B)                                   | 428-182-9-023               |                     |             |                             |
|                     | Line Cord, 3 Wire CSA                                           | 420-039-9-001               |                     |             |                             |
|                     | Trace Rotation Coil                                             | 040-008-9-001               |                     |             |                             |
|                     | Wire Assembly (J14 to VAR.)                                     | 428-182-9-018               |                     |             |                             |
|                     | Wire Assembly (J17 to X10 MAG<br>Switch)                        | 428-182-9-019               |                     |             |                             |
|                     | Wire Assembly (J26A to J26B)                                    | 428-182-0-024               |                     |             |                             |
|                     | Wire Assembly (J8A to J8B)                                      | 428-182-9-025               |                     |             |                             |
|                     | Wire Assembly (J27A to J27B)                                    | 428-182-9-026               |                     |             |                             |
|                     | Wire Assembly (J3A to J3B)                                      | 428-182-9-027               |                     |             |                             |
| <b>MECHANICAL</b>   |                                                                 |                             |                     |             |                             |
| DS604, 605          | Lamp Holder, Acrylic                                            | 380-643-9-002               |                     |             |                             |
|                     | AC Cord Wrap/Rear Foot                                          | 380-643-9-003               |                     |             |                             |
|                     | CAL Terminal                                                    | 777-109-9-001               |                     |             |                             |
|                     | CRT Rubber Pad, Lower (2 Used)                                  | 381-198-9-001               |                     |             |                             |
|                     | CRT Rubber Pad, Upper (1 Used)                                  | 381-198-9-002               |                     |             |                             |
|                     | CRT Neck Rubber                                                 | 381-196-9-001               |                     |             |                             |
|                     | CRT Holder Plate, Upper                                         | 250-298-9-004               |                     |             |                             |
|                     | CRT Holder Plate, Lower                                         | 250-298-9-003               |                     |             |                             |
|                     | CRT Support Plate                                               | 250-298-9-002               |                     |             |                             |
|                     | CRT Ground Plate                                                | 250-298-9-001               |                     |             |                             |
|                     | CRT Clip, Copper                                                | 741-206-9-002               |                     |             |                             |
|                     | CRT Filter, Blue                                                | 380-643-9-001               |                     |             |                             |
|                     | CRT Shield                                                      | 256-300-9-001               |                     |             |                             |
|                     | CRT Socket, 14 Pin                                              | 749-121-9-001               |                     |             |                             |
|                     | Bottom Cover                                                    | 252-073-9-001               |                     |             |                             |
|                     | Cable Tie                                                       | 380-529-9-001               |                     |             |                             |
|                     | Cover, Handle (Chrome)                                          | 746-076-9-003               |                     |             |                             |
|                     | Clamp, Tilt Stand                                               | 741-221-9-001               |                     |             |                             |
|                     | Dust Cover (VERT MODE Switch,<br>AC/GND/DC Switch)              | 769-211-9-001               |                     |             |                             |
|                     | Dust Cover (SLOPE/COUPLING<br>SOURCE Switch)                    | 769-192-9-003               |                     |             |                             |
|                     | Frame, Right Plate                                              | 254-145-9-002               |                     |             |                             |
|                     | Frame, Middle Plate                                             | 254-145-9-003               |                     |             |                             |
|                     | Frame, Left Plate                                               | 254-145-9-004               |                     |             |                             |
|                     | Frame, P.C. Board Plate                                         | 254-145-9-005               |                     |             |                             |
|                     | Front Plastic Frame                                             | 380-643-9-004               |                     |             |                             |
|                     | Front Panel (Metal-Sub)                                         | 254-145-9-001               |                     |             |                             |
|                     | Front Panel Nameplate Inlay                                     | 260-526-9-001               |                     |             |                             |
|                     | Front Panel Power, Focus, etc., Inlay                           | 260-527-9-001               |                     |             |                             |
|                     | Front Panel Main Inlay                                          | 260-528-9-001               |                     |             |                             |
|                     | Fuse Label, 1/2 A                                               | 483-699-9-003               |                     |             |                             |
|                     | Ground Terminal                                                 | 740-053-9-001               |                     |             |                             |
|                     | Handle (Outer)                                                  | 746-076-9-001               |                     |             |                             |
|                     | High Voltage Shield Cover, Lower                                | 256-274-9-002               |                     |             |                             |
|                     | Instruction Manual                                              | 480-664-9-001               |                     |             |                             |
|                     | Knob, Gray, 10mm                                                | 751-371-9-001               |                     |             |                             |
|                     | Knob, Gray w/Set Screw,<br>15mm (HOLD OFF)                      | 751-371-9-002               |                     |             |                             |
|                     | Knob, Dark Gray, w/Set Screw,<br>10mm (VOLT/DIV VAR.)           | 751-371-9-003               |                     |             |                             |
|                     | Knob, Gray, w/Set Screw,<br>19mm (VOLTS/DIV)                    | 751-371-9-004               |                     |             |                             |
|                     | Knob, Gray, w/ Set Screw,<br>23mm (TIME/DIV)                    | 751-371-9-005               |                     |             |                             |
|                     | Knob, Dark Gray, 10mm (LEVEL)                                   | 751-371-9-006               |                     |             |                             |
|                     | Knob, Gray, 16mm<br>Swp. Var                                    | 751-371-9-007               |                     |             |                             |
|                     | Lever Switch Knob, Gray                                         | 384-138-9-001               |                     |             |                             |
|                     | Mesh (Fire Resistant)                                           | 763-212-9-001               |                     |             |                             |
|                     | Nameplate, Front                                                | 260-526-9-001               |                     |             |                             |
|                     | Pushbutton Switch Bezel                                         | 380-643-9-005               |                     |             |                             |
|                     | Rear Panel                                                      | 262-082-9-001               |                     |             |                             |
|                     | Rear Panel Overlay                                              | 600-198-9-001               |                     |             |                             |
|                     | Rubber Foot                                                     | 381-197-9-001               |                     |             |                             |
|                     | Rubber Pad (Under CRT Shield)                                   | 381-178-9-004               |                     |             |                             |
|                     | Set Screw, 3 x 3mm x 0.5P<br>(Knobs)                            | 633-010-9-001               |                     |             |                             |

COMPOSITE  
499-403-9-001

**SCHEMATIC  
SYMBOL**

| DESCRIPTION                                                                                          | B & K-PRECISION<br>PART NO. | SCHEMATIC<br>SYMBOL | DESCRIPTION                                                                                              | B & K-PRECISION<br>PART NO. |
|------------------------------------------------------------------------------------------------------|-----------------------------|---------------------|----------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>FINAL ASSY (Continued)</b>                                                                        |                             |                     |                                                                                                          |                             |
| Set Screw, 3 x 5mm x 0.5P<br>(knobs) .....                                                           | 633-010-9-002               |                     | 3 x 6mm, 0.5P, Phillips Pan Head<br>Machine Screw (Tilt Stand, PC<br>Boards, Brackets, Case, Etc.) ..... | 634-202-9-006               |
| Standoff, 18mm long .....                                                                            | 759-252-9-001               |                     | 3 x 10mm, 0.5P Phillips Pan Head<br>Machine Screw (Feet) .....                                           | 634-238-9-002               |
| Steel Strap, Handle (Inner) .....                                                                    | 746-076-9-002               |                     | 3 x 12mm, 0.5P, Phillips Pan Head<br>Machine Screw (Cord Wrap and<br>CRT Clamp) .....                    | 634-202-9-003               |
| Switch Button, Gray .....                                                                            | 384-115-9-002               |                     | 3 x 14mm, 0.5P Phillips Flat Head<br>Machine Screw (Handle) .....                                        | 634-202-9-009               |
| Switch Button, Red .....                                                                             | 384-079-9-003               |                     | 4 x 8mm, 0.7P Phillips Pan Head<br>Machine Screw (Transformer) .....                                     | 634-240-9-001               |
| Tilt Stand .....                                                                                     | 763-213-9-001               |                     |                                                                                                          |                             |
| Top Cover .....                                                                                      | 253-155-9-001               |                     |                                                                                                          |                             |
| 3 x 6mm, 0.5P Phillips Flat Head<br>Machine Screw (Standoff Sub<br>Panels and SubPanel Frames) ..... | 634-202-9-002               |                     |                                                                                                          |                             |

**SWEEP MODE SWITCH LINE SELECT...PC BOARD ASSEMBLY**  
**546-058-9-001**

| RESISTORS                                                           |                                                                                    |               | C704                | 1 pF±0.5 pF, 50 V, NPO Ceramic                          | 031-073-9-001 |
|---------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------|---------------------|---------------------------------------------------------|---------------|
| Unlisted resistors are ±5%, 1/4 W. See schematic diagram for value. |                                                                                    |               | C705                | 220 pF±5%, 50 V, NPO Ceramic                            | 031-073-9-002 |
| SWITCHES                                                            |                                                                                    |               |                     |                                                         |               |
| R703                                                                | 10 kΩ, 1/4 W, ±1% Metal Film                                                       | 015-144-1-002 | S302, S404          | Pushbutton Switch, 4 Station<br>(ALT, AUTO/NORM/SINGLE) | 088-178-9-002 |
| R704                                                                | 10 kΩ, 1/4 W, ±1% Metal Film                                                       | 015-144-1-002 | S601                | Pushbutton Switch, 1 Station<br>(ON/OFF)                | 088-178-9-001 |
| R705, 706,                                                          | 100 kΩ, 1/4 W, ±1% Metal Film                                                      | 015-144-1-003 | DIODES              |                                                         |               |
| R711                                                                | 10 kΩ, 1/4 W, ±1% Metal Film                                                       | 015-144-1-002 | D405                | 1N4148                                                  | 151-038-9-001 |
| R712                                                                | 2.0 kΩ, 1/4 W, ±1% Metal Film                                                      | 015-144-2-001 | DS401               | LED, Red                                                | 158-102-9-001 |
| VR111/S104                                                          | 10 kΩ, Potentiometer w/Switch<br>(CH1 POSITION/PULL CHOP<br>ONLY)                  | 008-881-9-005 | DS603               | LED, Red                                                | 158-076-9-001 |
| VR211/S204                                                          | 10 kΩ, Potentiometer w/Switch<br>(CH2 POSITION/PULL INVERT)                        | 008-881-9-005 | DZ606 – 609         | 36 V, 2.2%, 500 mW, Zener                               | 152-186-9-001 |
| VR402/S406                                                          | 10 kΩ/100 kΩ Dual Potentiometer<br>w/Switch (LEVEL, HOLD OFF /<br>ALT/CHOP SWITCH) | 008-881-9-006 | DZ613               | 5.6V, +1.79% - 2.5% Zener                               | 152-186-9-004 |
| VR605                                                               | 10 kΩ Potentiometer (INTEN)                                                        | 008-881-9-004 | TRANSISTORS         |                                                         |               |
| VR606                                                               | 200 kΩ, Potentiometer (FOCUS)                                                      | 008-881-9-001 | Q614, 615           | 2SC1846R NPN                                            | 176-142-9-002 |
| VR607                                                               | 10 kΩ Potentiometer (ILLUM)                                                        | 008-881-9-004 | INTEGRATED CIRCUITS |                                                         |               |
| VR608                                                               | 2 kΩ Potentiometer (ROTATION)                                                      | 008-881-9-007 | U701                | 4011B Quad 2-Input NAND Gate                            | 308-144-9-001 |
| VR701                                                               | 100 kΩ Trimmer Potentiometer<br>(FREQUENCY)                                        | 010-061-9-001 | MISCELLANEOUS       |                                                         |               |
| CAPACITORS                                                          |                                                                                    |               | DS604, 605          | 14 V, 80 mA Lamp                                        | 400-101-9-001 |
| C418                                                                | 1000 pF, ±10%, 50 V, Ceramic                                                       | 020-430-9-001 | J9B, 13B            | 2 Pin PC Terminal, Right Angle<br>Small                 | 757-147-9-002 |
| C419                                                                | 0.1 μF, +80/-20%, 50 V, Ceramic                                                    | 020-430-9-002 | J21A                | 2 Pin PC Terminal, Large                                | 757-148-9-002 |
| C601, 602                                                           | 1000 pF, +80/-20%, 6.3 KV,<br>Ceramic                                              | 020-430-9-003 | J21B                | 2 Pin PC Terminal (Special)                             | 757-147-9-001 |
| C701                                                                | 47 μF, +80/-20%, 25 V, Electrolytic                                                | 022-328-9-001 | J22                 | 3 Pin PC Terminal, Large                                | 757-148-9-003 |
| C702, 703                                                           | .01 μF±1%, 100 V, Metalized,<br>Polyester                                          | 025-250-9-002 | J23A – 23E          | 5 Pin PC Terminal, Large                                | 757-148-9-005 |
|                                                                     |                                                                                    |               | J33, 34             | 2 Pin IC Terminal, Small                                | 757-144-9-001 |

VERTICAL INPUT OUTPUT, POWER SUPPLY & SWITCHING CIRCUIT PC BOARD ASSY  
546-026-9-001

| RESISTORS                                                                  |                                                 |               |           |                                                   |               |
|----------------------------------------------------------------------------|-------------------------------------------------|---------------|-----------|---------------------------------------------------|---------------|
| Unlisted resistors are $\pm 5\%$ , 1/4 W. See schematic diagram for value. |                                                 |               |           |                                                   |               |
| R103                                                                       | 1 M $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film    | 015-124-1-004 | R233      | 56.2 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 015-144-5-622 |
| R104                                                                       | 900 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film  | 013-010-9-011 | R235      | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film      | 015-144-4-750 |
| R105                                                                       | 111 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film  | 013-034-9-036 | R236      | 56.2 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 015-144-5-622 |
| R107                                                                       | 990 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film  | 013-010-9-012 | R239, 240 | 681 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film      | 015-144-6-810 |
| R108                                                                       | 10.1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film | 013-034-9-035 | R247, 248 | 1.54 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 014-144-1-541 |
| R111                                                                       | 470 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film | 002-102-5-474 | R254, 255 | 1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film      | 015-144-1-001 |
| R123                                                                       | Resistor Network                                | 012-047-9-002 | R303, 304 | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film      | 015-144-4-750 |
| R125, 126                                                                  | 121 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-1-210 | R310      | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film      | 015-144-4-750 |
| R132                                                                       | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-4-750 | R311, 312 | 90.9 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film     | 015-144-9-098 |
| R133                                                                       | 56.2 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film | 015-144-5-622 | R313      | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film      | 015-144-4-750 |
| R135                                                                       | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-4-750 | R315      | 90.9 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film     | 015-144-9-098 |
| R136                                                                       | 56.2 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film | 015-144-5-622 | R325, 326 | 33 k $\Omega$ , $\pm 5\%$ , 1 W, Metal Oxide      | 011-001-5-333 |
| R139, 140                                                                  | 681 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-6-810 | R328, 329 | 47 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film    | 002-102-5-473 |
| R147, 148                                                                  | 1.54 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film | 014-144-1-541 | R355      | 10 k $\Omega$ , $\pm 5\%$ , Resistor Network      | 012-047-9-003 |
| R154, 155                                                                  | 1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-1-001 | R600, 601 | 3.9 k $\Omega$ , $\pm 5\%$ , 2 W, Metal Oxide     | 004-236-9-004 |
| R203                                                                       | 1 M $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film    | 015-124-1-004 | R603      | 100 $\Omega$ , $\pm 5\%$ , 1 W, Metal Oxide       | 011-001-5-101 |
| R204                                                                       | 900 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film  | 013-010-9-011 | R607      | 121 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film    | 015-124-1-213 |
| R205                                                                       | 111 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film  | 013-034-9-036 | R608      | 10.1 k $\Omega$ , $\pm 0.5\%$ , 1/4 W, Metal Film | 017-144-1-102 |
| R207                                                                       | 990 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film  | 013-010-9-012 | R609      | 1.0 $\Omega$ , $\pm 5\%$ , 1 W, Metal Oxide       | 011-001-5-019 |
| R208                                                                       | 10.1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film | 013-034-9-035 | R612      | 2.2 $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film     | 002-102-5-229 |
| R211                                                                       | 470 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film | 002-102-5-474 | R613      | 100 $\Omega$ , $\pm 5\%$ , 1 W, Metal Oxide       | 011-001-5-101 |
| R223                                                                       | Resistor Network                                | 012-047-9-002 | R614      | 68 $\Omega$ , $\pm 5\%$ , 1 W, Metal Oxide        | 011-001-5-680 |
| R225, 226                                                                  | 121 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-1-210 | R616      | 3.92 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 015-144-3-921 |
| R232                                                                       | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film    | 015-144-4-750 | R617      | 9.09 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 015-144-9-091 |
|                                                                            |                                                 |               | R619      | 12.1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 015-144-1-212 |
|                                                                            |                                                 |               | R622      | 12.1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film   | 015-144-1-212 |
|                                                                            |                                                 |               | R623      | 100 $\Omega$ , $\pm 5\%$ , 1 W, Metal Oxide       | 011-001-5-101 |

| SCHEMATIC SYMBOL                                                                 | DESCRIPTION                                                         | B & K-PRECISION PART NO. | SCHEMATIC SYMBOL    | DESCRIPTION                                                                 | B & K-PRECISION PART NO. |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------|---------------------|-----------------------------------------------------------------------------|--------------------------|
| <b>VERTICAL INPUT OUTPUT, POWER SUPPLY &amp; SWITCHING CIRCUIT PC BOARD ASSY</b> |                                                                     |                          |                     |                                                                             |                          |
| <b>(Continued)</b>                                                               |                                                                     |                          |                     |                                                                             |                          |
| R624, 625                                                                        | 2.2 M $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film                     | 002-102-5-225            | C127                | 22 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                        | 031-068-9-003            |
| TH101, 102, 201                                                                  | 250 $\Omega$ , $\pm 15\%$ , Thermistor                              | 005-022-9-001            | C128                | 10 $\mu$ F, $\pm 80/-20\%$ , 50 V, Electrolytic                             | 022-390-9-001            |
| VR101                                                                            | 22 k $\Omega$ , Trimmer Potentiometer (STEP BAL)                    | 010-061-9-010            | C201                | .022 $\mu$ F, $\pm 5\%$ , 630 V, Metalized Film Polyester                   | 025-282-9-009            |
| VR102                                                                            | 100 $\Omega$ , Trimmer Potentiometer (X5 GAIN)                      | 010-061-9-006            | C202                | 33 pF, $\pm 5\%$ , 500 V, NPO Ceramic                                       | 031-073-9-010            |
| VR103                                                                            | 470 $\Omega$ , Trimmer Potentiometer (1ST COMP)                     | 010-061-9-011            | C203                | 270 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                       | 031-073-9-006            |
| VR104                                                                            | 22 k $\Omega$ , Trimmer Potentiometer (MAG DC BAL)                  | 010-061-9-010            | C204                | 220 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                       | 031-073-9-002            |
| VR106                                                                            | 22 k $\Omega$ , Trimmer Potentiometer (VAR DC BAL)                  | 010-061-9-010            | C205                | 2200 pF, $\pm 5\%$ , 400 V, Metalized Film Polyester                        | 025-282-9-008            |
| VR107                                                                            | 220 $\Omega$ , Trimmer Potentiometer (2ND COMP)                     | 010-061-9-008            | C206                | 10 pF, $\pm 5\%$ , 500 V, NPO Ceramic                                       | 031-073-9-009            |
| VR108                                                                            | 1 k $\Omega$ , Trimmer Potentiometer (CH1 GAIN)                     | 010-061-9-007            | C207                | 1000 pF, $\pm 10\%$ , 500 V, Ceramic                                        | 020-430-9-006            |
| VR109                                                                            | 100 $\Omega$ , Trimmer Potentiometer (X-GAIN)                       | 010-061-9-006            | C208, 209           | 0.1 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                                 | 020-430-9-002            |
| VR110                                                                            | 1 k $\Omega$ , Trimmer Potentiometer (CH1 TRIG DC OFFSET)           | 010-061-9-007            | C210                | 1000 pF, $\pm 10\%$ , 500 V, Ceramic                                        | 020-430-9-006            |
| VR112                                                                            | 2.2 k $\Omega$ , Trimmer Potentiometer (SIGNAL OUT DC OFFSET)       | 010-061-9-009            | C211                | 10 $\mu$ F, $\pm 80/-20\%$ , 50 V, Electrolytic                             | 022-390-9-001            |
| VR201                                                                            | 22 k $\Omega$ , Trimmer Potentiometer (STEP BAL)                    | 010-061-9-010            | C212                | 15 pF, $\pm 5\%$ , 500 V, NPO Ceramic                                       | 031-073-9-004            |
| VR202                                                                            | 100 $\Omega$ , Trimmer Potentiometer (X GAIN)                       | 010-061-9-006            | C213                | 220 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                       | 031-073-9-002            |
| VR203                                                                            | 470 $\Omega$ , Trimmer Potentiometer (1ST COMP)                     | 010-061-9-011            | C214, 215           | 5 pF, $\pm 0.5$ pF, 500 V, NPO Ceramic                                      | 031-073-9-008            |
| VR204                                                                            | 22 k $\Omega$ , Trimmer Potentiometer (MAG DC BAL)                  | 010-061-9-010            | C216, 217           | 82 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                        | 031-073-9-007            |
| VR206                                                                            | 22 k $\Omega$ , Trimmer Potentiometer (VAR DC BAL)                  | 010-061-9-010            | C218                | 47 pF, 500 V, NPO Ceramic                                                   | 031-073-9-005            |
| VR207                                                                            | 220 $\Omega$ , Trimmer Potentiometer (2ND COMP)                     | 010-061-9-008            | C219, 220, 222, 224 | .01 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                                 | 020-380-9-001            |
| VR208                                                                            | 1 k $\Omega$ , Trimmer Potentiometer (CH2 GAIN)                     | 010-061-9-007            | C225, 226           | 220 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                       | 031-073-9-002            |
| VR210                                                                            | 1 k $\Omega$ , Trimmer Potentiometer (CH2 TRIG DC OFFSET, STEP BAL) | 010-061-9-007            | C227                | 22 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                        | 031-068-9-003            |
| VR301                                                                            | 470 $\Omega$ , Trimmer Potentiometer (ADD BAL)                      | 010-061-9-011            | C228                | 10 $\mu$ F, $\pm 80/-20\%$ , 50 V, Electrolytic                             | 022-390-9-001            |
| VR302                                                                            | 2.2 k $\Omega$ , Trimmer Potentiometer (3RD COMP)                   | 010-061-9-009            | C301                | 5 pF, $\pm 0.5$ pF, 500 V, NPO Ceramic                                      | 031-073-9-008            |
| VR601                                                                            | 1 k $\Omega$ , Trimmer Potentiometer (+12 V ADJ)                    | 010-061-9-007            | C302, 303           | 15 pF, $\pm 5\%$ , 500 V, NPO Ceramic                                       | 031-073-9-004            |
| <b>CAPACITORS</b>                                                                |                                                                     |                          |                     |                                                                             |                          |
| C11                                                                              | 100 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 201-069-9-003            | C304, 305           | .01 $\mu$ F, $\pm 5\%$ , 100 V, Polyester                                   | 025-282-9-006            |
| C12                                                                              | 22 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                | 031-068-9-003            | C306, 307           | 0.47 pF, 0.25 pF, 500 V, NPO Ceramic                                        | 031-073-9-011            |
| C13                                                                              | 100 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 201-069-9-003            | C308, 309           | .047 $\mu$ F, $\pm 5\%$ , 250 V, Metalized Film Polyester                   | 025-282-9-007            |
| C14                                                                              | 68 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                | 031-073-9-012            | C310                | 0.1 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                                 | 020-430-9-002            |
| C15                                                                              | 5 pF, $\pm 0.5$ pF, 500 V, NPO Ceramic                              | 031-073-9-008            | C311                | .022 $\mu$ F, $\pm 5\%$ , 630 V, Metalized Film Polyester                   | 025-282-9-009            |
| C21                                                                              | 100 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 201-069-9-003            | C312                | 0.1 $\mu$ F, $\pm 5\%$ , 100 V, Polyester                                   | 025-282-9-002            |
| C22                                                                              | 22 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                | 031-068-9-003            | C313                | .022 $\mu$ F, $\pm 5\%$ , 630 V, Metalized Film Polyester                   | 025-282-9-009            |
| C23                                                                              | 100 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 201-069-9-003            | C314                | 1.0 $\mu$ F, $\pm 80/-20\%$ , 160 V, Electrolytic                           | 021-085-9-001            |
| C24                                                                              | 68 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                | 031-073-9-012            | C315, 316           | .01 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                                 | 020-380-9-001            |
| C101                                                                             | .022 $\mu$ F, $\pm 5\%$ , 630 V, Metal Film Polyester               | 025-282-9-009            | C317                | 1500 pF, $\pm 10\%$ , 50 V, Ceramic                                         | 020-430-9-009            |
| C102                                                                             | 33 pF, $\pm 5\%$ , 500 V, NPO Ceramic                               | 031-073-9-010            | C318                | 1000 pF, $\pm 10\%$ , 500 V, Ceramic                                        | 020-430-9-006            |
| C103                                                                             | 270 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 031-073-9-006            | C319, 320           | .01 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                                 | 020-380-9-001            |
| C104                                                                             | 220 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 031-073-9-002            | C321, 322           | 100 $\mu$ F, $\pm 80/-20\%$ , 25 V, Electrolytic                            | 022-328-9-002            |
| C105                                                                             | 2200 pF, $\pm 5\%$ , 400 V, Metalized Film Polyester                | 025-282-9-008            | C323, 324           | 10 $\mu$ F, $\pm 80/-20\%$ , 50 V, Electrolytic                             | 022-390-9-001            |
| C106                                                                             | 10 pF, $\pm 5\%$ , 500 V, NPO Ceramic                               | 031-073-9-009            | C325                | 10 pF, $\pm 5\%$ , 500 V, NPO Ceramic                                       | 031-073-9-009            |
| C107                                                                             | 1000 pF, $\pm 10\%$ , 500 V, Ceramic                                | 020-430-9-006            | C603                | 47 $\mu$ F, $\pm 80/-20\%$ , 200 V, Electrolytic                            | 021-085-9-002            |
| C108, 109                                                                        | 0.1 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                         | 020-430-9-002            | C604                | 4.7 $\mu$ F, $\pm 80/-20\%$ , 350 V, Electrolytic                           | 021-085-9-003            |
| C110                                                                             | 1000 pF, $\pm 10\%$ , 500 V, Ceramic                                | 020-430-9-006            | C605                | 1.0 $\mu$ F, $\pm 80/-20\%$ , 160 V, Electrolytic                           | 021-085-9-001            |
| C111                                                                             | 10 $\mu$ F, $\pm 80/-20\%$ , 50 V, Electrolytic                     | 022-390-9-001            | C606                | 47 $\mu$ F, $\pm 80/-20\%$ , 25 V, Electrolytic                             | 022-328-9-001            |
| C112                                                                             | 15 pF, $\pm 5\%$ , 500 V, NPO Ceramic                               | 031-073-9-004            | C607, 608           | 1000 $\mu$ F, $\pm 80/-20\%$ , 25 V, Electrolytic                           | 022-335-9-004            |
| C113                                                                             | 220 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 031-073-9-002            | C609, 610           | .022 $\mu$ F, $\pm 5\%$ , 100 V, Polyester                                  | 025-282-9-003            |
| C114, 115                                                                        | 5 pF, $\pm 0.5$ pF, 500 V, NPO Ceramic                              | 031-073-9-008            | VC101               | 3-10 pF Trimmer                                                             | 028-114-9-002            |
| C116, 117                                                                        | 82 pF, $\pm 5\%$ , 50 V, NPO Ceramic                                | 031-073-9-007            | VC102               | 2.5-6 pF Trimmer                                                            | 028-114-9-001            |
| C118                                                                             | 47 pF, 500 V, NPO Ceramic                                           | 031-073-9-005            | VC103               | 4.5-20 pF Trimmer                                                           | 028-114-9-003            |
| C119, 120, 122                                                                   | .01 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                         | 020-380-9-001            | VC104               | 2.5-6 pF Trimmer                                                            | 028-114-9-001            |
| C123                                                                             | 10 $\mu$ F, $\pm 80/-20\%$ , 50 V, Electrolytic                     | 022-390-9-001            | VC105               | 4.5-20 pF Trimmer                                                           | 028-114-9-003            |
| C124                                                                             | .01 $\mu$ F, $\pm 80/-20\%$ , 50 V, Ceramic                         | 020-380-9-001            | VC106               | 7.5-50 pF Trimmer                                                           | 028-114-9-004            |
| C125, 126                                                                        | 220 pF, $\pm 5\%$ , 50 V, NPO Ceramic                               | 031-073-9-002            | VC201               | 3-10 pF Trimmer                                                             | 028-114-9-002            |
|                                                                                  |                                                                     |                          | VC202               | 2.5-6 pF Trimmer                                                            | 028-114-9-001            |
|                                                                                  |                                                                     |                          | VC203               | 4.5-20 pF Trimmer                                                           | 028-114-9-003            |
|                                                                                  |                                                                     |                          | VC204               | 2.5-6 pF Trimmer                                                            | 028-114-9-001            |
|                                                                                  |                                                                     |                          | VC205               | 4.5-20 pF Trimmer                                                           | 028-114-9-003            |
|                                                                                  |                                                                     |                          | VC206               | 7.5-50 pF Trimmer                                                           | 028-114-9-004            |
|                                                                                  |                                                                     |                          | VC301               | 4.5-20 pF Trimmer                                                           | 028-114-9-003            |
| <b>SWITCHES</b>                                                                  |                                                                     |                          |                     |                                                                             |                          |
|                                                                                  |                                                                     |                          | S101                | 3 Position Lever Switch (AC GND DC)                                         | 080-031-9-003            |
|                                                                                  |                                                                     |                          | S103/VR105          | Rotary Switch w/Potentiometer (VOLTS/DIV Attenuator)                        | 083-325-9-001            |
|                                                                                  |                                                                     |                          | S201                | 3 Position Lever Switch (AC GND DC)                                         | 080-031-9-003            |
|                                                                                  |                                                                     |                          | S203/VR205          | Rotary Switch w/Potentiometer (VOLTS/DIV Attenuator/PULL X5 MAG / VARIABLE) | 083-325-9-001            |
|                                                                                  |                                                                     |                          | S301                | 4 Position Lever Switch (VERT MODE)                                         | 080-031-9-001            |

SCHEMATIC  
SYMBOL

## DESCRIPTION

B & K-PRECISION  
PART NO.SCHEMATIC  
SYMBOL

## DESCRIPTION

B & K-PRECISION  
PART NO.VERTICAL INPUT OUTPUT, POWER SUPPLY & SWITCHING CIRCUIT PC BOARD ASSY  
(Continued)

## DIODES

|                                                     |                                       |               |
|-----------------------------------------------------|---------------------------------------|---------------|
| BD601, 602                                          | 2 A, 600 V, Bridge (2W06M)            | 157-039-9-001 |
| D101 - 107,<br>201 - 206,<br>301 - 316,<br>601, 602 | 1N4148                                | 151-038-9-001 |
| DZ101, 201                                          | 3.3 V, $\pm 3\%$ , 500 mW, Zener      | 152-186-9-003 |
| DZ301, 302                                          | 2.2 V, $\pm 4.5\%$ , 500 mW, Zener    | 152-186-9-002 |
| DZ601, 602                                          | 13 V, $\pm 4.7$ -3.1%, 500 mW, Zener  | 152-186-9-005 |
| DZ603                                               | 5.6 V, $\pm 1.7$ -2.5%, 500 mW, Zener | 152-186-9-004 |

## TRANSISTORS

|            |               |               |
|------------|---------------|---------------|
| Q101       | 2SC1730K NPN  | 176-222-9-001 |
| Q102       | 2SK121-3 FET  | 182-101-9-002 |
| Q103       | 2SC945Q NPN   | 176-059-9-003 |
| Q104       | 2SA844D PNP   | 177-021-9-001 |
| Q105       | 2SC945Q NPN   | 176-059-9-003 |
| Q106, 107  | 2SA1206K PNP  | 177-065-9-001 |
| Q108, 109  | 2SA838C PNP   | 177-036-9-001 |
| Q110       | 2SC1730K NPN  | 176-222-9-001 |
| Q111, 112  | 2SA838C PNP   | 177-036-9-001 |
| Q201       | 2SC1730K NPN  | 176-222-9-001 |
| Q202       | 2SK121-3 FET  | 182-101-9-002 |
| Q203       | 2SC945Q NPN   | 176-059-9-003 |
| Q204       | 2SA844D PNP   | 177-021-9-001 |
| Q205       | 2SC945Q NPN   | 176-059-9-003 |
| Q206, 207  | 2SA1206K PNP  | 177-065-9-001 |
| Q208 - 213 | 2SA838C PNP   | 177-036-9-001 |
| Q301, 302  | 2SA1206K PNP  | 177-065-9-001 |
| Q303 - 305 | 2SC1730K NPN  | 176-222-9-001 |
| Q306, 307  | 2SA1206K PNP  | 177-065-9-001 |
| Q308       | 2SC1730K NPN  | 176-222-9-001 |
| Q309       | 2SA1360-0 PNP | 173-024-9-002 |
| Q310, 311  | 2SC3423-0 NPN | 172-082-9-004 |
| Q312       | 2SA1360-0 PNP | 173-024-9-002 |

|           |                   |               |
|-----------|-------------------|---------------|
| Q313, 314 | 2SC2570A NPN      | 176-222-9-003 |
| Q315, 316 | 2SA844D PNP       | 177-021-9-001 |
| Q601      | 2SB861C PNP       | 173-024-9-003 |
| Q602      | 2SD880Y NPN Power | 172-082-9-001 |
| Q603      | 2SB834Y PNP Power | 173-024-9-004 |
| Q604      | 2SD880Y NPN Power | 172-082-9-001 |

## INTEGRATED CIRCUITS

|            |                                |               |
|------------|--------------------------------|---------------|
| U101       | 3140 Operational Amplifier     | 308-191-9-001 |
| U102       | 3086 Transistor Array          | 307-087-9-001 |
| U201       | 3140 Operational Amplifier     | 308-191-9-001 |
| U202       | 3086 Transistor Array          | 307-087-9-001 |
| U301       | 74LS74AN Dual D Flip-Flop      | 307-361-9-006 |
| U302 - 304 | 74S00N Quad 2-Input NAND Gate  | 307-100-9-001 |
| U601, 602  | 4558C BCD-TO-7 Segment Decoder | 307-435-9-003 |

## INDUCTORS AND TRANSFORMERS

|           |                               |               |
|-----------|-------------------------------|---------------|
| L301, 302 | 0.14 $\mu$ H, $\pm 20\%$ Coil | 047-075-9-002 |
|-----------|-------------------------------|---------------|

## MISCELLANEOUS

|           |                                |               |
|-----------|--------------------------------|---------------|
| J1        | 2 Pin PC Terminal, Small       | 757-144-9-002 |
| J2A, 4A   | 5 Pin PC Terminal, Small       | 757-149-9-002 |
| J5A       | 2 Pin PC Terminal, Small       | 757-144-9-002 |
| J6, 7     | 1 Pin PC Terminal, Large       | 757-148-9-001 |
| J8A       | 4 Pin PC Terminal, Small       | 757-149-9-003 |
| J9A       | 2 Pin PC Terminal, Small       | 757-144-9-002 |
| J24       | 5 Pin PC Terminal, Large       | 757-148-9-005 |
| J25A      | 2 Pin PC Terminal, Small       | 757-144-9-002 |
| J26A      | 5 Pin PC Terminal, Small       | 757-149-9-002 |
| J27A, 28A | 6 Pin PC Terminal, Small       | 757-149-9-004 |
|           | Heat Sink (for Q309 - 312)     | 747-164-9-002 |
|           | Heat Sink (for Q601, 603, 604) | 747-164-9-003 |
|           | Heat Sink                      | 747-164-9-004 |
|           | Insulator, Transistor          | 347-140-9-001 |

## HORIZ SWEEP, TRIGGER &amp; HIGH VOLTAGE PC BOARD ASSEMBLY

546-025-9-001

## RESISTORS

Unlisted resistors are  $\pm 5\%$ , 1/4 W. See schematic diagram for value.

|            |                                                          |               |
|------------|----------------------------------------------------------|---------------|
| R402       | 1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film             | 015-144-1-001 |
| R411       | 1 M $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film             | 015-124-1-004 |
| R417, 418  | 681 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film             | 015-144-6-810 |
| R459       | 33.2 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-3-322 |
| R460       | 22.1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-2-212 |
| R474       | 2.21 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-2-211 |
| R481       | Resistor Network                                         | 012-047-9-001 |
| R483       | 1.62 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 014-144-1-621 |
| R486       | 475 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film             | 015-144-4-750 |
| R487       | 3.92 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-3-921 |
| R503       | 56.2 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film            | 015-144-5-628 |
| R504 - 507 | 5.62 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-5-621 |
| R508 - 510 | 1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film             | 015-144-1-001 |
| R511       | 562 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film             | 015-144-5-620 |
| R512, 513  | 332 $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film             | 015-144-3-320 |
| R515       | 100 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film          | 002-102-5-104 |
| R516       | 100 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film           | 015-124-1-003 |
| R518       | 100 k $\Omega$ , $\pm 1\%$ , 1/2 W, Metal Film           | 015-124-1-003 |
| R523       | 100 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film          | 002-102-5-104 |
| R626       | 100 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film           | 015-144-1-003 |
| R630       | 8.25 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-8-251 |
| R631       | 12.1 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film          | 015-144-1-212 |
| R634       | 1.0 $\Omega$ , $\pm 1\%$ , 1 W, Metal Oxide              | 004-236-9-002 |
| R638       | 2.2 M $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film          | 002-102-5-225 |
| R639, 640  | 10 M $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film           | 002-102-5-106 |
| R645       | 1.5 M $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film          | 002-102-5-155 |
| R646       | 6.8 M $\Omega$ , $\pm 1\%$ , 1.6 W, Metal Glaze          | 004-236-9-003 |
| R647       | 10 M $\Omega$ , $\pm 1\%$ , 2.5 W, Metal Glaze           | 004-236-9-001 |
| R648, 649  | 10 M $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film           | 002-102-5-106 |
| R651       | 1.5 M $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film          | 002-102-5-155 |
| R657, 658  | 47 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film           | 002-102-5-473 |
| R661, 662  | 47 k $\Omega$ , $\pm 5\%$ , 1/2 W, Carbon Film           | 002-102-5-473 |
| R670       | 100 k $\Omega$ , $\pm 1\%$ , 1/4 W, Metal Film           | 015-144-1-003 |
| VR401      | 47 k $\Omega$ , Trimmer Potentiometer (X-AXIS DC-OFFSET) | 010-061-9-004 |

|       |                                                        |               |
|-------|--------------------------------------------------------|---------------|
| VR403 | 10 k $\Omega$ , Trimmer Potentiometer (TRIG BAL)       | 010-061-9-002 |
| VR404 | 470 k $\Omega$ , Trimmer Potentiometer (1 $\mu$ S ADJ) | 010-061-9-005 |
| VR405 | 10 k $\Omega$ , Trimmer Potentiometer (1mS ADJ)        | 010-061-9-002 |
| VR602 | 2.2 M $\Omega$ , Trimmer Potentiometer (SUB FOCUS)     | 010-061-9-003 |
| VR603 | 10 k $\Omega$ , Trimmer Potentiometer (SUB INTEN)      | 010-033-9-003 |
| VR604 | 100 k $\Omega$ , Trimmer Potentiometer (ASTIG)         | 010-061-9-001 |

## CAPACITORS

|           |                                                           |               |
|-----------|-----------------------------------------------------------|---------------|
| C402      | .01 $\mu$ F, $\pm 80$ /-20%, 50 V, Ceramic                | 020-380-9-001 |
| C403      | 10 $\mu$ F, $\pm 80$ /-20%, 50 V, Electrolytic            | 022-390-9-001 |
| C404      | .022 $\mu$ F, $\pm 5\%$ , 100 V, Polyester                | 025-282-9-003 |
| C405, 406 | 47 pF, $\pm 5\%$ , 500 V, NPO Ceramic                     | 031-073-9-005 |
| C407      | 470 pF, $\pm 10\%$ , 50 V, Ceramic                        | 020-430-9-008 |
| C408,     | 10 $\mu$ F, $\pm 80$ /-20%, 50 V, Electrolytic            | 022-390-9-001 |
| C410, 411 | 47 $\mu$ F, $\pm 80$ /-20%, 25 V, Electrolytic            | 022-328-9-001 |
| C412      | 10 $\mu$ F, $\pm 80$ /-20%, 50 V, Electrolytic            | 022-390-9-001 |
| C413      | 1.0 $\mu$ F, $\pm 10\%$ , 35 V, Tantalum                  | 027-096-9-001 |
| C414      | 100 $\mu$ F, $\pm 80$ /-20%, 25 V, Electrolytic           | 022-328-9-002 |
| C415      | 0.1 $\mu$ F, $\pm 5\%$ , 100 V, Polyester                 | 025-282-9-002 |
| C416      | 47 pF, $\pm 5\%$ , 500 V, NPO Ceramic                     | 031-073-9-005 |
| C417      | 47 $\mu$ F, $\pm 80$ /-20%, 25 V, Electrolytic            | 022-328-9-001 |
| C420, 422 | 1000 pF, $\pm 10\%$ , 500 V, Ceramic                      | 020-430-9-006 |
| C421      | 10 $\mu$ F, $\pm 80$ /-20%, 50 V, Electrolytic            | 022-390-9-001 |
| C423      | .01 $\mu$ F, $\pm 5\%$ , 100 V, Polyester                 | 025-282-9-001 |
| C424      | 47 pF, $\pm 5\%$ , 500 V, NPO Ceramic                     | 031-073-9-005 |
| C425      | 47 $\mu$ F, $\pm 80$ /-20%, 25 V, Electrolytic            | 022-328-9-001 |
| C426      | 1000 pF, $\pm 5\%$ , 100 V, Metal Film Polyester          | 025-282-9-004 |
| C427      | 100 pF, $\pm 5\%$ , 50 V, NPO Ceramic                     | 031-069-9-003 |
| C428      | 1.0 $\mu$ F, $\pm 5\%$ , 100 V, Metallized Film Polyester | 025-282-9-005 |
| C429      | .01 $\mu$ F, $\pm 80$ /-20%, 50 V, Ceramic                | 020-380-9-001 |
| C430      | 15 pF, $\pm 5\%$ , 500 V, NPO Ceramic                     | 031-073-9-004 |
| C431      | 47 $\mu$ F, $\pm 80$ /-20%, 25 V, Electrolytic            | 022-328-9-001 |

| SCHEMATIC SYMBOL                                                 | DESCRIPTION                              | B & K-PRECISION PART NO. | SCHEMATIC SYMBOL                  | DESCRIPTION                      | B & K-PRECISION PART NO. |
|------------------------------------------------------------------|------------------------------------------|--------------------------|-----------------------------------|----------------------------------|--------------------------|
| <b>HORIZ SWEEP, TRIGGER &amp; HIGH VOLTAGE PC BOARD ASSEMBLY</b> |                                          |                          |                                   |                                  |                          |
| <b>(Continued)</b>                                               |                                          |                          |                                   |                                  |                          |
| C432                                                             | .01 $\mu$ F, +80/-20%, 50 V, Ceramic     | 020-380-9-001            | Q410                              | 2SK40C FET                       | 182-101-9-003            |
| C433, 434                                                        | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q411                              | 2SK117BL FET                     | 182-101-9-001            |
| C435                                                             | 100 pF, $\pm$ 5%, 50 V, NPO Ceramic      | 031-069-9-003            | Q412                              | 2SA1015-GR PNP                   | 177-057-9-001            |
| C501                                                             | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q413                              | 2SA838C PNP                      | 177-036-9-001            |
| C502 - 506                                                       | .01 $\mu$ F, +80/-20%, 500 V, Ceramic    | 020-430-9-007            | Q414, 415                         | 2SC1730K NPN                     | 176-222-9-001            |
| C507                                                             | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q416                              | 2SA844D PNP                      | 177-021-9-001            |
| C611                                                             | 1.0 $\mu$ F, $\pm$ 10%, 35 V, Tantalum   | 027-096-9-001            | Q417                              | 2SC945Q NPN                      | 176-059-9-003            |
| C612                                                             | 4700 pF, $\pm$ 10%, 50 V, Ceramic        | 020-430-9-005            | Q418                              | 2SC1730K NPN                     | 176-222-9-001            |
| C613                                                             | .022 $\mu$ F, $\pm$ 5%, 100 V, Polyester | 025-282-9-003            | Q419, 420                         | 2SC945Q NPN                      | 176-059-9-003            |
| C614                                                             | 22 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-002            | Q421, 422                         | 2SA844D PNP                      | 177-021-9-001            |
| C618                                                             | 4700 pF, +80/-20%, 3 KV, Ceramic         | 020-430-9-004            | Q423                              | 2SC945Q NPN                      | 176-059-9-003            |
| C619                                                             | 1000 pF, +80/-20%, 6.3 KV, Ceramic       | 020-430-9-003            | Q424                              | 2SA844D PNP                      | 177-021-9-001            |
| C620                                                             | .01 $\mu$ F, +80/-20%, 500 V, Ceramic    | 020-430-9-007            | Q425, 426                         | 2SK117BL FET                     | 182-101-9-001            |
| C621 - 625                                                       | 1000 pF, +80/-20%, 6.3 KV, Ceramic       | 020-430-9-003            | Q427                              | 2SC945Q NPN                      | 176-059-9-003            |
| C626                                                             | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q428                              | 2SA844D PNP                      | 177-021-9-001            |
| C627                                                             | .01 $\mu$ F, +80/-20%, 500 V, Ceramic    | 020-430-9-007            | Q429                              | 2SC1843E NPN                     | 176-222-9-002            |
| C628                                                             | .01 $\mu$ F, +80/-20%, 50 V, Ceramic     | 020-380-9-001            | Q430, 431                         | 2SA844D PNP                      | 177-021-9-001            |
| C629                                                             | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q501, 502                         | 2SA1015-GR PNP                   | 177-057-9-001            |
| C630                                                             | 220 pF, $\pm$ 5%, 50 V, NPO Ceramic      | 031-073-9-002            | Q503, 504                         | 2SC945Q NPN                      | 176-059-9-003            |
| C631                                                             | .01 $\mu$ F, +80/-20%, 50 V, Ceramic     | 020-380-9-001            | Q505 - 507                        | 2SC1730K NPN                     | 176-222-9-001            |
| C632                                                             | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q508                              | 2SA838C PNP                      | 177-036-9-001            |
| C633                                                             | .01 $\mu$ F, +80/-20%, 500 V, Ceramic    | 020-430-9-007            | Q509                              | 2SB648A-B PNP Power              | 173-024-9-001            |
| C634                                                             | .022 $\mu$ F, $\pm$ 5%, 100 V, Polyester | 025-282-9-003            | Q510, 511                         | 2SD668A-C NPN Power              | 172-082-9-003            |
| C635, 636                                                        | 10 $\mu$ F, +80/-20%, 50 V, Electrolytic | 022-390-9-001            | Q512                              | 2SB648A-B PNP Power              | 173-024-9-001            |
| C637                                                             | 22 pF, $\pm$ 10%, 2 KV, NPO Ceramic      | 031-073-9-003            | Q605                              | 2SD880Y NPN Power                | 172-082-9-001            |
| C638                                                             | .01 $\mu$ F, +80/-20%, 50 V, Ceramic     | 020-380-9-001            | Q606 - 609                        | 2SC2371K NPN Power               | 172-082-9-002            |
| <b>SWITCHES</b>                                                  |                                          |                          | Q610, 611                         | 2SC1730K NPN                     | 176-222-9-001            |
| S401, 402                                                        | Lever Switch (SOURCE, COUPLING)          | 080-031-9-002            | Q612                              | 2SA844D PNP                      | 177-021-9-001            |
| S403                                                             | Lever Switch (SLOPE)                     | 080-031-9-001            | Q613                              | 2SK117BL FET                     | 182-101-9-001            |
| S405                                                             | Rotary Switch (TIME/DIV)                 | 083-324-9-001            | <b>INTEGRATED CIRCUITS</b>        |                                  |                          |
| <b>DIODES</b>                                                    |                                          |                          | U401                              | 74S00 Quad 2-Input NAND Gate     | 307-028-9-001            |
| D401, 402                                                        | 1N4148                                   | 151-038-9-001            | U402                              | 74LS112AN Dual JK Flip-Flop      | 307-259-9-025            |
| D403                                                             | 1SS86 (30 mA, 3 V)                       | 151-156-9-002            | U403                              | TL081CP Operational Amplifier    | 307-464-9-001            |
| D404, 406, 407                                                   | 1N4148                                   | 151-038-9-001            | U404                              | Triple 2CH Analog Multiplexer    | 308-375-9-003            |
| D408                                                             | 1SS86 (30 mA, 3 V)                       | 151-156-9-002            | U603                              | TL081CP Operational Amplifier    | 307-464-9-001            |
| D409 - 420                                                       | 1N4148                                   | 151-038-9-001            | <b>INDUCTORS AND TRANSFORMERS</b> |                                  |                          |
| D501                                                             | 1SS86 (30 mA, 3 V)                       | 151-156-9-002            | L601                              | 100 $\mu$ H, $\pm$ 10% Coil      | 047-075-9-001            |
| D502, 503                                                        | 1N4148                                   | 151-038-9-001            | T601                              | Pulse Transformer                | 064-033-9-001            |
| D504                                                             | 1SS83 (200 mA, 250 V)                    | 151-084-9-001            | <b>MISCELLANEOUS</b>              |                                  |                          |
| D603, 605, 606                                                   | 1N4148                                   | 151-038-9-001            | DS601, 602                        | NE-2 Neon Lamp                   | 401-002-9-001            |
| D609 - 613                                                       | 1SS83 (200 mA, 250 V)                    | 151-084-9-001            | J5B                               | 2 Pin PC Terminal, Small         | 757-144-9-002            |
| D614                                                             | 200 mA, 2 KV                             | 151-156-9-001            | J10                               | 1 Pin PC Terminal, Large         | 757-148-9-001            |
| D615, 616                                                        | 1SS83 (200 mA, 250 V)                    | 151-084-9-001            | J11A, 12A                         | 5 Pin PC Terminal, Small         | 757-149-9-002            |
| D617 - 620                                                       | 1N4148                                   | 151-038-9-001            | J13A                              | 2 Pin PC Terminal, Small         | 757-144-9-002            |
| DZ401                                                            | 3.3 V, $\pm$ 3%, 500 mW, Zener           | 152-186-9-003            | J14                               | 3 Pin PC Terminal, Small         | 757-149-9-001            |
| DZ402                                                            | 5.6 V, $\pm$ 1.7/-2.5%, 500 mW, Zener    | 152-186-9-004            | J15A, 15B,                        | 2 Pin PC Terminal, Small         | 757-144-9-002            |
| DZ604, 605                                                       | 2.2 V, $\pm$ 4.5%, 500 mW, Zener         | 152-186-9-002            | J16, 17                           | 3 Pin PC Terminal, Small         | 757-149-9-001            |
| DZ610                                                            | 5.6 V, $\pm$ 1.7/-2.5%, 500 mW, Zener    | 152-186-9-004            | J18, 19                           | 1 Pin PC Terminal, Large         | 757-148-9-001            |
| <b>TRANSISTORS</b>                                               |                                          |                          | J25B                              | 2 Pin PC Terminal, Small         | 757-144-9-002            |
| Q401, 402                                                        | 2SA838C PNP                              | 177-036-9-001            | J29                               | 2 Pin PC Terminal, Large         | 757-148-9-002            |
| Q403                                                             | 2SK121-3 FET                             | 182-101-9-002            | J30                               | 5 Pin PC Terminal, Large         | 757-148-9-005            |
| Q404, 405                                                        | 2SC1730K NPN                             | 176-222-9-001            | J31                               | 3 Pin PC Terminal, Large         | 757-148-9-003            |
| Q406 - 409                                                       | 2SA844D PNP                              | 177-021-9-001            | J32                               | 2 Pin PC Terminal, Small         | 757-144-9-002            |
|                                                                  |                                          |                          |                                   | Heat Sink                        | 747-164-9-001            |
|                                                                  |                                          |                          |                                   | Insulator, Transistor (For Q605) | 347-140-9-001            |
|                                                                  |                                          |                          |                                   | Multipier Assembly               | 524-020-9-001            |

# CALIBRATION PROCEDURE

## WARNING

*The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing unless qualified to do so.*

*High voltage up to 12 kV when covers are removed and the unit is operating. Remember that high voltage may be retained indefinitely on high voltage capacitors. Also remember that ac line voltage is present on line voltage input circuits (including the fuse holder, line cord receptacle, and POWER switch) anytime the instrument is plugged into an ac outlet, even if turned off. Unplug the oscilloscope and discharge high voltage capacitors before performing service procedures unless it is necessary to have the unit powered up.*

## GENERAL

This unit was carefully checked and calibrated at the factory prior to shipment. After the oscilloscope has been used for a period of time, it should be calibrated to maintain instrument accuracy. Calibration is also required if repairs have been made in a circuit affecting calibration. The location of the calibration adjustments is shown in Fig. 1 and Fig. 2. Keep in mind that some calibration adjustments require high precision test instruments. Those adjustments should be attempted only if the proper test equipment is available and you are experienced in its use. The unit should be calibrated at an ambient temperature of 23 degrees C ( $\pm 5$  degrees C). Before making adjustments connect the unit to AC line voltage, 50/60 Hz line source and allow at least 30 minutes of warmup time before proceeding. The following test equipment is required for complete calibration:

B & K-Precision Model 2906 Multimeter or equivalent.

B & K-Precision Model 1400 Oscilloscope Calibrator or equivalent.

B & K-Precision Model 1655 Variable AC Power Supply or equivalent with 120 V, 3 A capacity.

B & K-Precision Model PR-28 High Voltage Multiplier Probe or equivalent with capability of measuring at least 12 kV.

## NOTE

All voltage measurements are to be taken with respect to earth (chassis) ground unless otherwise noted.

The adjusting procedures MUST be done in sequence.

## POWER SUPPLY ADJUSTMENTS

Before you start to calibrate the oscilloscope, its DC supply voltage should be checked and adjusted.

### +12 V SUPPLY

Check the +12 V supply voltage and adjust if necessary. The other supply voltages should be checked and adjusted only after the +12 V adjustment has been completed.

1. Connect the digital voltmeter (DVM) between +12V and ground.
2. If necessary, adjust 12V ADJ for a  $+12\text{ V} \pm 0.05\text{ V}$  reading on the voltmeter.

### LOW VOLTAGE SUPPLY

1. Connect the DVM between -12V and ground. Acceptable limits are  $-12\text{ V} \pm 0.2\text{ V}$ .
2. Connect the DVM between +5V and ground. Acceptable limits are  $+5\text{ V} \pm 0.25\text{ V}$ .
3. Connect the DVM between +145V and ground. Acceptable limits are  $+145\text{ V} \pm 5\text{ V}$ .

### HIGH VOLTAGE SUPPLY(S)

1. Connect the DVM between -HV and ground.
2. Measure the voltage using a high voltage probe. Acceptable limits are between -1725 V and -1875 V.
3. The output of the multiplier should be approximately +10 kV

## CRT CIRCUIT ADJUSTMENT

### INTENSITY ADJUSTMENT

1. Set up the oscilloscope with the TIME/DIV switch set to 1 mS to display a single horizontal trace on the screen.

2. Turn the HOLD OFF knob to NORM and set the white mark of the INTENSITY control to the 10 o'clock position.
3. Adjust VR603 (SUB INTEN) until the trace displayed on the screen is just barely visible.

### FOCUS ADJUSTMENT

1. Set up the oscilloscope with the FOCUS control set to display the white dot in the upright or noon position.
2. Adjust VR602 (SUB FOCUS) to obtain the best focus.

### ASTIGMATISM ADJUSTMENT

1. Set up the oscilloscope with the TIME/DIV switch set to X-Y and the input coupling switch set to GND.
2. Use the position controls to display the beam spot in the center of the CRT screen.
3. Set the INTENSITY control for a small spot and turn the FOCUS control to obtain the sharpest image possible.
4. Adjust VR604 (ASTIG) so that the shape of the beam spot becomes as true a circle as possible.

## VERTICAL SYSTEM ADJUSTMENT

### DC BALANCE ADJUSTMENT

1. Set the channel 1 (CH 1) [channel 2 (CH 2)] AC-GND-DC switch to GND and the VERT MODE switch to CH 1 [CH 2] to display the trace on the CRT screen.
2. Set the VOLTS/DIV switch to 5 mV.
3. Position the trace to the horizontal center line and then change the VOLTS/DIV switch to 10 mV.
4. Check that the trace is within  $\pm 0.05$  division of the center horizontal line.
5. Adjust VR101 [VR201] (STEP BAL) for a trace at the center line.
6. Repeat steps 2 through 5 until a division shift of less than  $\pm 0.05$  is noted when changing the VOLTS/DIV setting.
7. Check the trace division for the other VOLTS/DIV ranges. The trace for each range must be within  $\pm 0.15$  of the center horizontal line.
8. Repeat procedure for CH 2 using data shown in brackets.

### X5 MAGNIFICATION DC BALANCE ADJUSTMENT

1. Set the CH 1 [CH 2] AC-GND-DC switch to GND and the VERT/MODE switch to CH 1 [CH 2].
2. Turn the CH 1 [CH 2] VOLTS/DIV VAR knob to CAL and the VOLTS/DIV setting to 10 mV.
3. Position the trace to the horizontal center line.
4. Pull out the VOLTS/DIV VAR knob and adjust VR104 [VR204] (MAG DC) for a trace at the horizontal center line.
5. Push the VOLTS/DIV VAR knob back to its normal position.
6. Repeat steps 3 through 5 until a horizontal center line division shift of less than  $\pm 0.2$  is obtained.
7. Repeat procedure for CH 2 using data shown in brackets.

### VARIABLE DC BALANCE ADJUSTMENT

1. Set the CH 1 [CH 2] AC-GND-DC switch to GND and the VERT MODE switch to CH 1 [CH 2] to display a trace on the CRT screen.
2. Set the VOLTS/DIV switch to 10 mV.

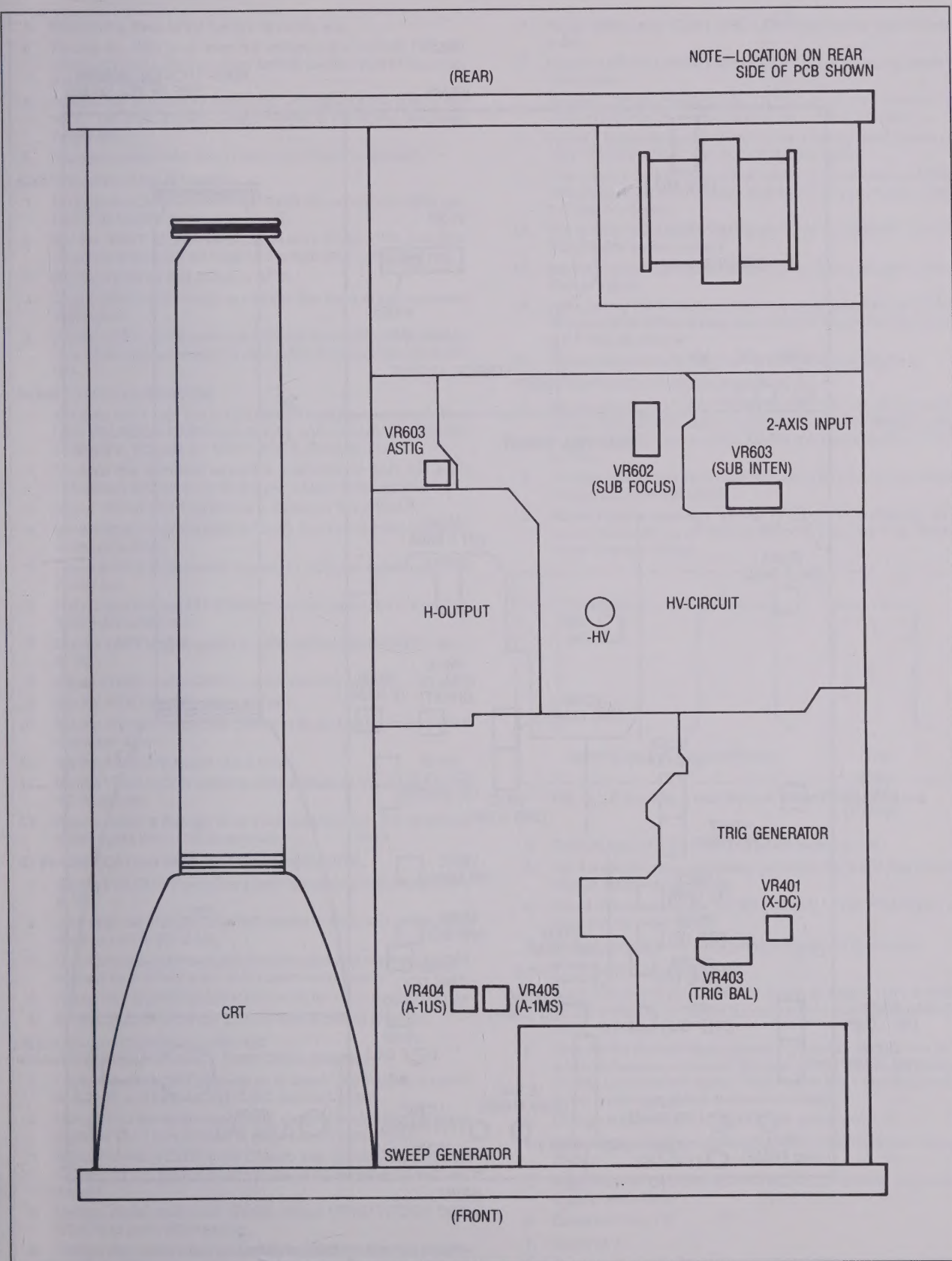


Fig. 1. Adjustment Locations (Top View)

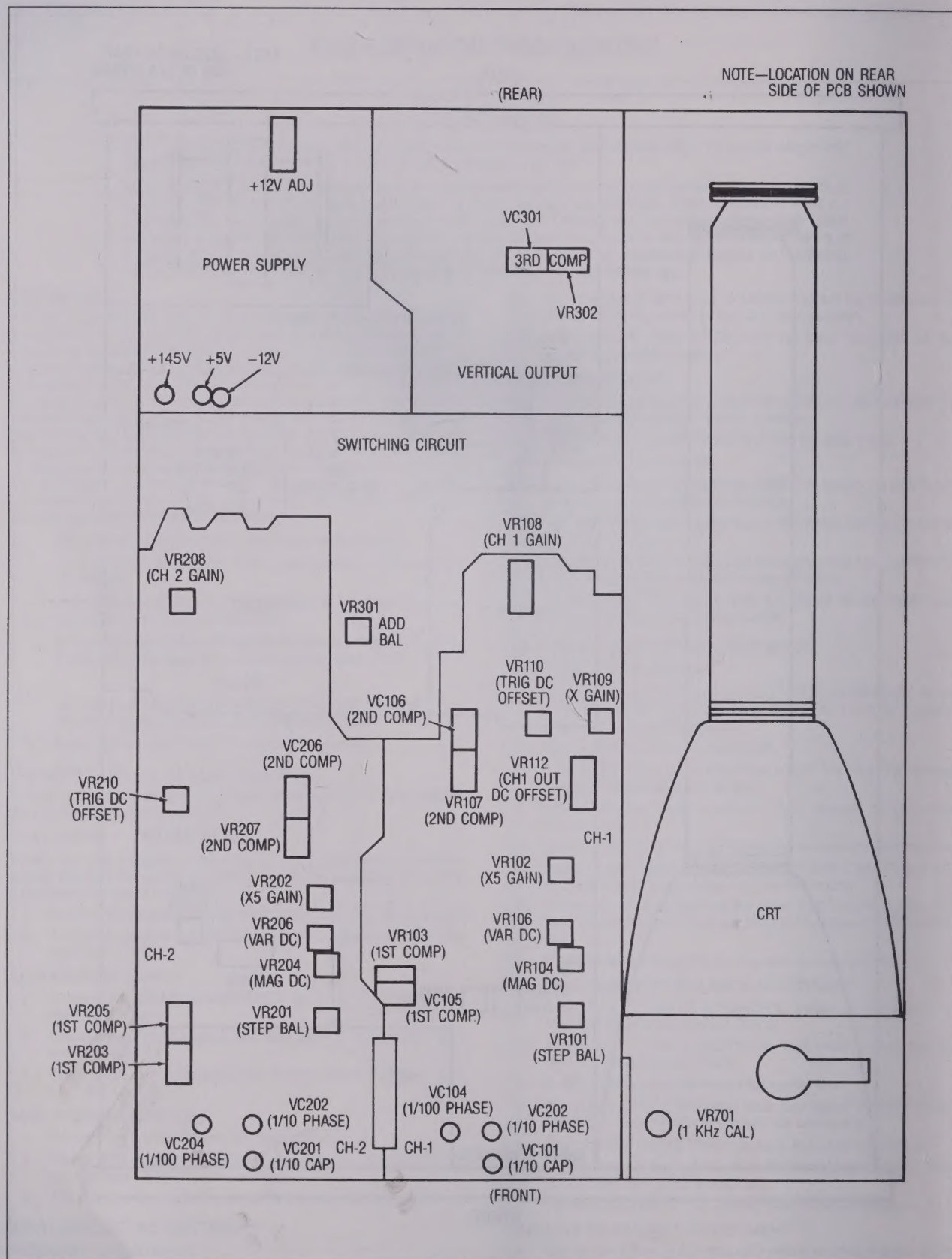


Fig. 2. Adjustment Locations (Bottom View)

- Position the trace to the horizontal center line.
- Turning the **VAR** knob from left to right adjust VR106 [VR206] (VAR DC) until a horizontal center line division shift of less than  $\pm 0.3$  is obtained.
- Pull out the **VOLTS/DIV VAR** knob and observe the shift of the trace. The shift division must be within  $\pm 0.6$  of the horizontal center line.
- Repeat procedure for CH 2 using data shown in brackets.

#### ADD BALANCE ADJUSTMENT

- Set both the CH 1 and CH 2 **AC-GND-DC** switches to **GND** and both **VOLTS/DIV** switches to **10 mV**.
- Set the **VERT MODE** switch separately to the **CH1** and **CH2** positions to position the trace to the horizontal center line.
- Set the **VERT MODE** switch to **ADD**.
- Adjust VR301 (ADD BAL) to position the trace to the horizontal center line.
- Set the **VERT MODE** switch to each position (**CH1**, **CH2**, **DUAL**) The trace division must be within  $\pm 0.5$  of the center horizontal line.

#### SENSITIVITY CALIBRATION

- Set both CH 1 and CH 2 **VOLTS/DIV** switches to **10 mV**. Turn both **VOLTS/DIV VAR** knobs to **CAL** and set both **AC-GND-DC** switches to **DC**. Set the **VERT MODE** switch to **CH 1**.
- Connect the standard amplitude calibrator to both the input connectors and set for a 50 mV p-p square-wave signal.
- Adjust VR108 (CH 1 GAIN) for a display of five divisions.
- Set the **VERT MODE** switch to **DUAL** and both the **AC-GND-DC** switches to **GND**.
- Turn the **CH 1 POS** control to position the trace at the horizontal center line.
- Pull out and turn the **CH 2 POS** control to position the trace at the horizontal center line.
- Set the **VERT MODE** switch to **ADD** and the **AC-GND-DC** switch to **DC**.
- Adjust VR208 (CH 2 GAIN) to align the CRT screen.
- Set the **VERT MODE** switch to **CH 1**.
- Set the standard amplitude calibrator for an eight division 50 kHz sine-wave signal.
- Set the **TIME/DIV** switch to **0.2 mS**.
- Set the **VERT MODE** switch to **ADD** and check the division of the AC amplitude.
- Repeat steps 4 through 9 as necessary until an AC amplitude division less than 0.06 is obtained.

#### X5 MAGNIFICATION SENSITIVITY CALIBRATION

- Set the **VOLTS/DIV** switch to **10 mV** and the input coupling switch to **DC**.
- Turn both the **VOLTS/DIV VAR** knobs to **CAL** and pull out the knob to set the **X5 MAG**.
- Connect the standard amplitude calibrator to the input connectors and set for a 10 mV p-p 1 kHz square-wave signal.
- Adjust VR102 [VR202] (X5 MAG GAIN) for a five division display.
- Repeat procedure for CH 2 using data shown in brackets.

#### SQUARE-WAVE CHARACTERISTIC ADJUSTMENT/FREQUENCY RESPONSE CHECK

- Set both the **VOLTS/DIV** switches to **10 mV**, the **TIME/DIV** switch to **0.2  $\mu$ S**, and both **AC-GND-DC** switches to **AC**.
- Using a 50 $\Omega$  termination and cable, connect the 20 MHz sine-wave signal to CH 1 [CH 2] input to get a four division display.
- Adjust VC105 [VC205] (1ST COMP) and VC106 [VC206] (2ND COMP) for the maximum amplitude of signal wave on the CRT screen.
- Using a digital multimeter (DMM), Adjust VR107 [VR207] (2ND COMP) to get a 90 $\Omega$  reading.
- Using a 50 $\Omega$  termination and cable, connect the fast-rise positive output (1 MHz) of the square-wave generator to the input.
- Adjust the square-wave generator output for a six division display.

- Adjust VR302 and VC301 (3RD COMP) so that the square-wave is flat.
- Readjust VR107 [VR207] (2ND COMP) to get a flat (top) square-wave form.
- Readjust VR103 [VR203] (1ST COMP) for an overshoot of 0.1 division and ringing of waveform of less than 0.3 division.
- Connect the sine-wave generator to the input connectors and set for a 100 kHz, 80 mV p-p, eight division display.
- Change only the frequency of the sine-wave generator to 43 MHz. The amplitude of the sine-wave on the CRT screen must be above 5.6 division display.
- Pull out the **VOLTS/DIV VAR** knob to set at **X5 MAG**. Turn the **VOLTS/DIV** switch to **5 mV**.
- Set the sine-wave generator for a 100 KHz, 8 mV p-p, eight division display signal.
- Change only the frequency of the sine-wave generator to 21 MHz. The amplitude of the sine-wave on the CRT screen must be above a 5.6 division display.
- Repeat procedure for CH 2 using data shown in brackets.

#### PHASE COMPENSATION ADJUSTMENT

- Set the CH 1 [CH 2] **VOLTS/DIV** switch to **0.1 V**. Set the CH 1 [CH 2] **AC-GND-DC** switch to **DC**. Set the **VERT MODE** switch to **CH 1** [CH 2]. Turn the **VOLTS/DIV VAR** knob of CH 1 [CH 2] to **CAL**.
- Set the oscilloscope calibration generator for a 0.5 V, five division display square-wave signal.
- Adjust trimmer capacitor VC102 [VC202] (1/10 PHASE) for a square-wave that is an ideal waveform. (See Fig 3 for Square Wave Characteristics)

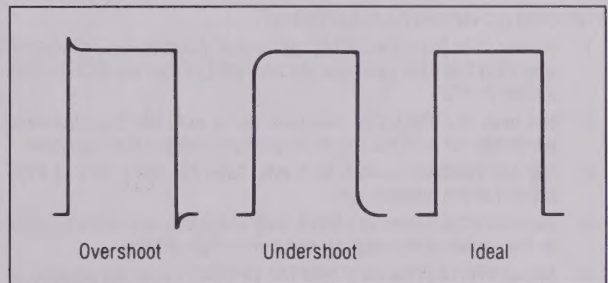


Fig. 3. Adjusting 1 kHz Square Wave Characteristics

- Change the CH 1 [CH 2] **VOLTS/DIV** switch to **1 V**.
- Set the oscilloscope calibration generator for a 5 V, five division display square-wave signal.
- Adjust trimmer capacitor VC104 [VC204] (1/100 PHASE) for an ideal square-wave form.
- Repeat procedure for CH 2 using data shown in brackets.

#### INPUT CAPACITY ADJUSTMENT

- Set the CH 1 [CH 2] **VOLTS/DIV** switch to **10 mV**. Set the **VERT MODE** switch to **CH 1** [CH 2]. Set the CH 1 [CH 2] **AC-GND-DC** switch to **DC**.
- Connect the oscilloscope calibration generator through the 10: 1 probe to the input connector. Set for a 1 kHz, 500 mV, five division display square-wave signal. Then, adjust the trimmer capacitor of the probe for an ideal square-wave form.
- Change the CH 1 [CH 2] **VOLTS/DIV** switch to **0.1 V**.
- Adjust the oscilloscope calibration generator for a five division display.
- Adjust trimmer capacitor VC101 [VC201] (1/10 CAP) for an ideal square-wave form.
- Same as 3 but 1 V.
- Same as 4.
- Same as 5 but VC103 [VC203] (1/100 CAP).
- Repeat procedure for CH 2 using data shown in brackets.

## TIMEBASE ADJUSTMENT

### A SWEEP TIME CALIBRATION

1. Set the **TIME/DIV** switch to **1 mS**. Turn the **SWEEP/VAR** knob to **CAL**. Set the **VERT MODE** switch to **CH 1**.
2. Set the time mark generator to **1 mS** (1 kHz pulse train) time marks.
3. Adjust VR405 (A-1 mS) so that the time marks coincide with the middle eight graticule lines.
4. Change the **TIME/DIV** switch to **1  $\mu$ S**. Change the time mark generator for **1  $\mu$ S** time marks.
5. Adjust VR404 (A-1  $\mu$ S) so that the time marks coincide with the middle eight graticule marks.

## HORIZONTAL AXIS ADJUSTMENT

### X GAIN ADJUSTMENT

1. Set the **VOLTS/DIV** switch to **10 mV**. Set the **TIME/DIV** switch to **X-Y**. Set the **COUPLING** switch to **AC**.
2. Set the **CH 1 AC-GND-DC** Switch to **AC**. Set the **SOURCE** and **VERT MODE** switches to **X-Y**. Turn the **CH 1 VOLTS/DIV VAR** knob to **CAL**.
3. Connect the oscilloscope calibration generator to the **CH 1** input connector, set for **1 kHz, 0.1 V p-p square-wave**.
4. Adjust VR109 (X-GAIN) so that the trace is a ten division display.
5. Adjust the oscilloscope calibration generator for a two division display.
6. Pull out the **X5 MAG** control and check that the horizontal trace is within  $10 \pm 0.3$  divisions on the CRT screen.

## TRIGGER SYSTEM ADJUSTMENT

### TRIGGER DC OFFSET ADJUSTMENT

1. Set the **CH 1 [CH 2] AC-GND-DC** switch to **AC**. Set the **SOURCE** and **VERT MODE** switches to **CH 1 [CH 2]**. Set the **COUPLING** switch to **AC**.
2. Set both the **TIME/DIV** switches to **10 mV**. Set the sinewave generator for a **1 kHz, 80 mV p-p, eight division display** signal.
3. Set the **TIME/DIV** switch to **1 mS**. Turn the **CH 1 [CH 2] POS** control to the midposition.
4. Turn the **POS** control of **LEVEL** so that the trigger point is brought to the center of the displayed waveform amplitude.
5. Adjust VR110 [VR210] (TRIG DC OFFSET) until the position of the trigger point is not affected by alternate **AC** and **DC** positions of the **COUPLING** switch.
6. Repeat procedure for **CH 2** using data shown in brackets.

### CH 1 DC OFFSET SIGNAL OUTPUT ADJUSTMENT

1. Set the **VERT MODE** switch to **DUAL** and the **SOURCE** switch to **CH 1**.
2. Set both the **AC-GND-DC** switches to **GND**.
3. Set the **CH 2 VOLTS/DIV** switch to **10 mV**. Turn the **CH 2 POS** control to its midposition.
4. Using a coaxial cable, connect the **CH 1** signal output to the **CH 2** input terminal.
5. Change the **CH 2 AC-GND-DC** switch to **DC**.
6. Adjust VR112 (CH 1 OUT DC OFFSET) so that the trace is within  $\pm 0.2$  division of the center horizontal line.

### X-Y POSITION ADJUSTMENT

1. Set the **TIME/DIV** switch to **1 mS**.
2. Align the start point of the sweep with the left hand of the CRT graticule with the **POS** control of **LEVEL**.
3. Set the **TIME/DIV** switch to **X-Y**.
4. Adjust VR401 (X-DC) so that the beam spot is positioned at the center of the CRT graticule.

## TRIGGER SLOPE BALANCE ADJUSTMENT

1. Set the **VERT MODE** switch to **CH 1**.
2. Turn the **LEVEL VAR** knob counterclockwise to **FIX**.
3. Set the **TIME/DIV** switch to **5 mS**.
4. Connect the **1 kHz** sinewave signal to the **CH 1** input to get a **0.4** division display on the CRT screen.
5. Adjust VR403 (TRIG BAL) until the signal waveform has a steady and inverse waveform on the CRT screen when the operation is switched between **+ SLOPE** and **- SLOPE**. (See example in Figs. 4 & 5)

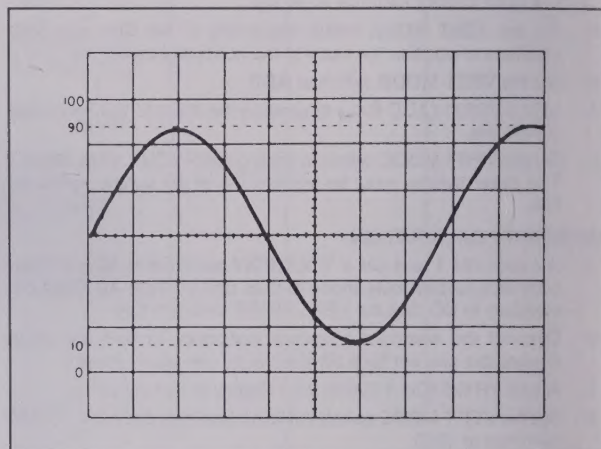


Fig. 4. Adjusting Trigger Point

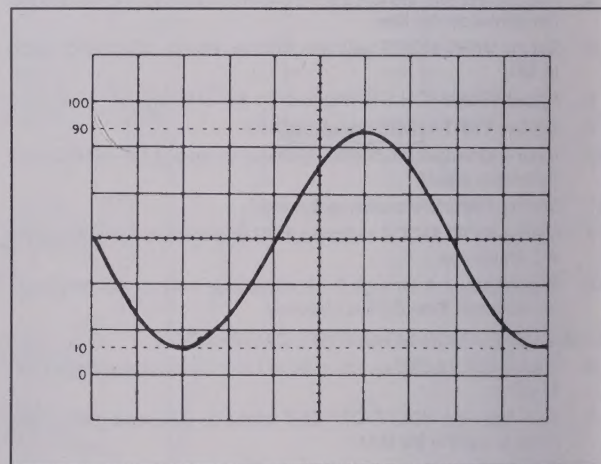
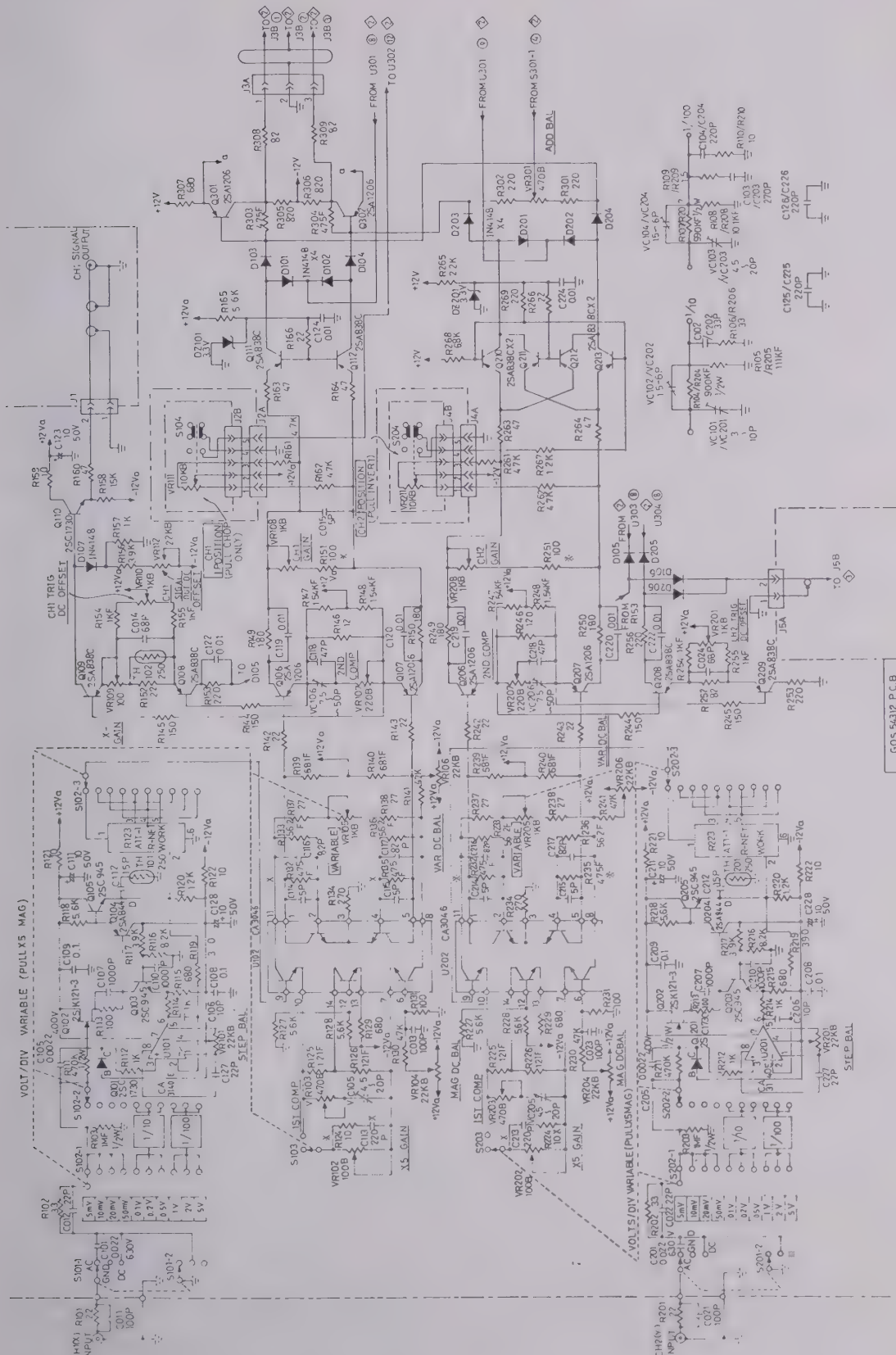


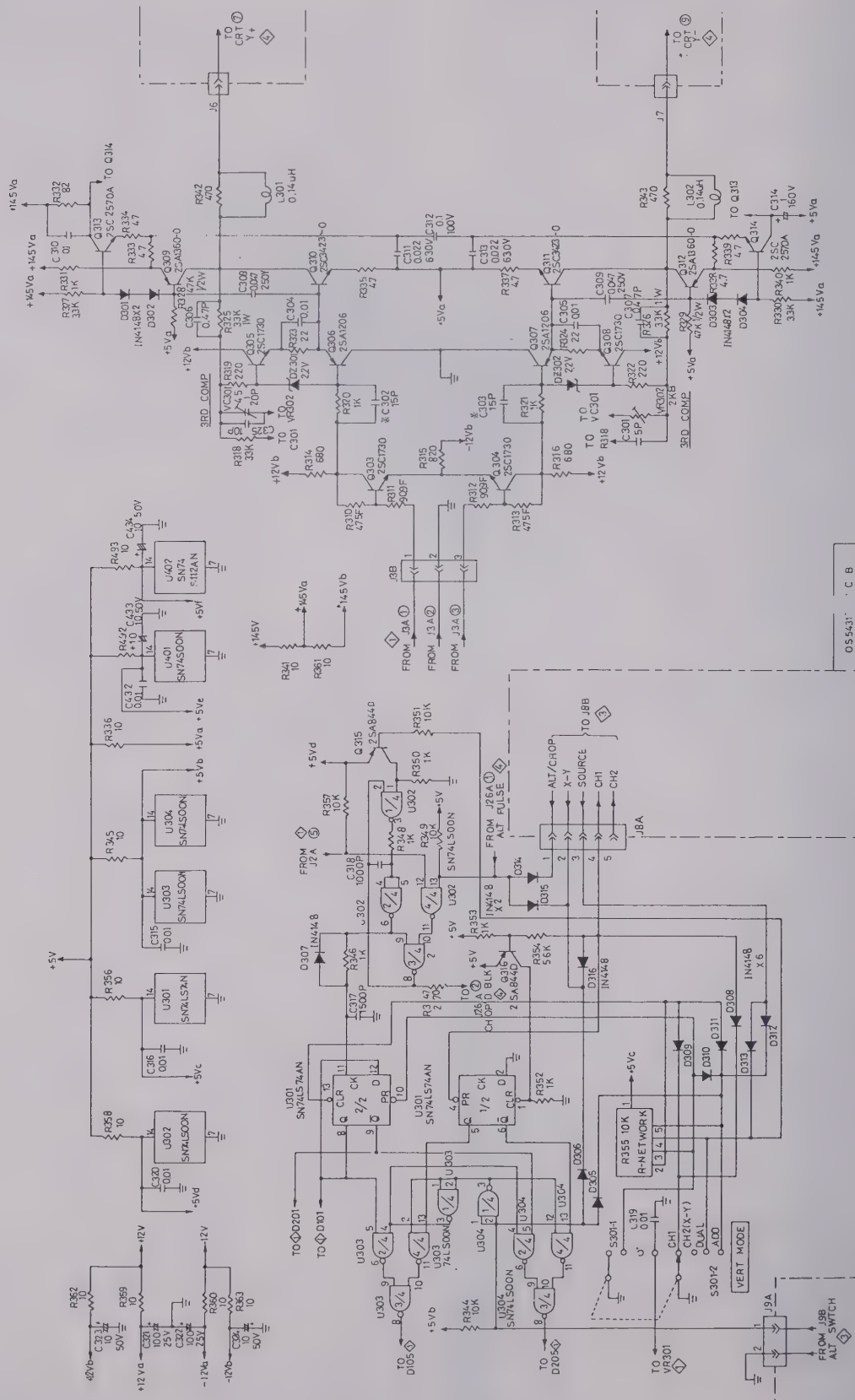
Fig. 5. Adjusting Trigger Point

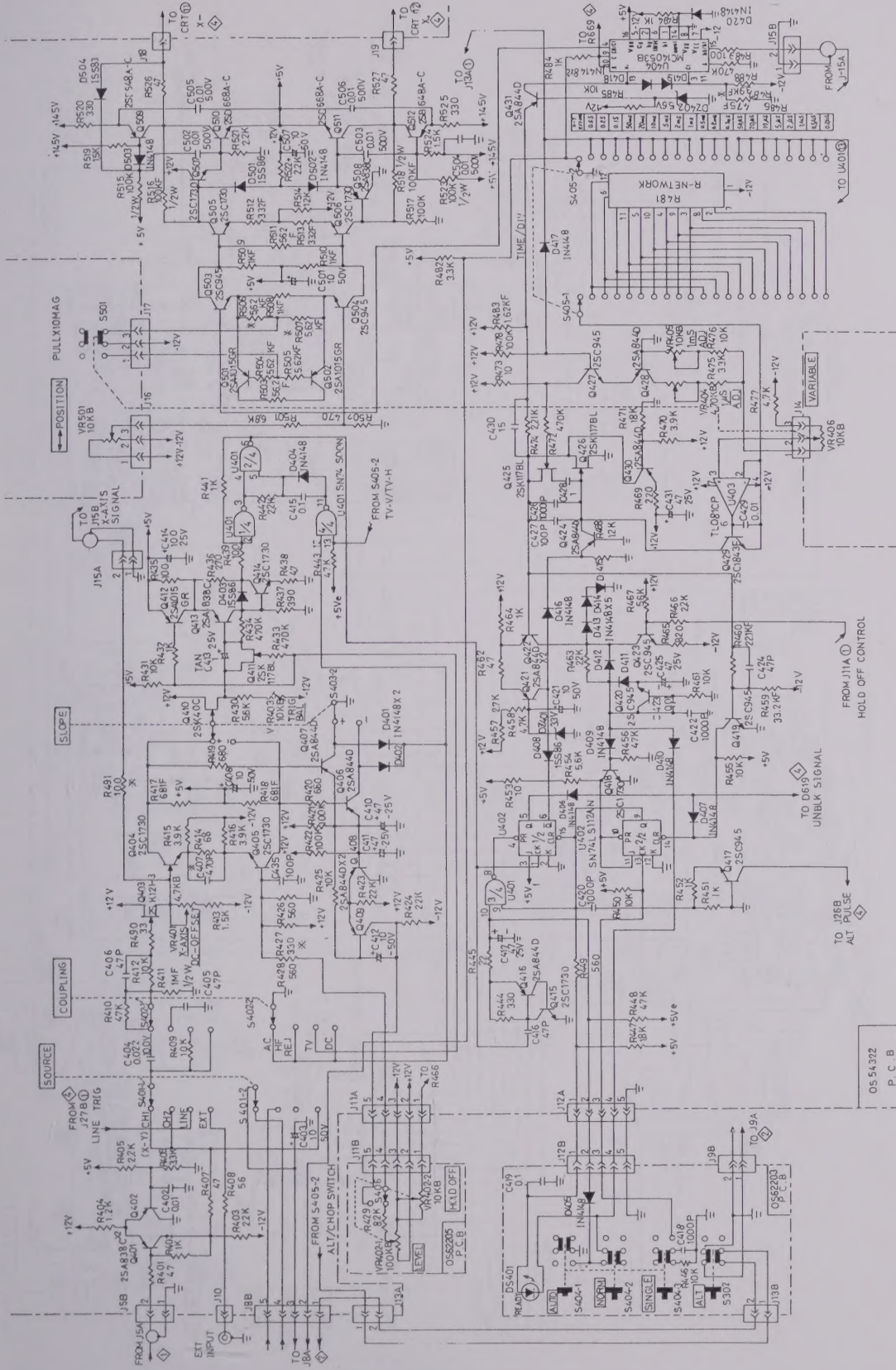
## CALIBRATOR OUTPUT ADJUSTMENT

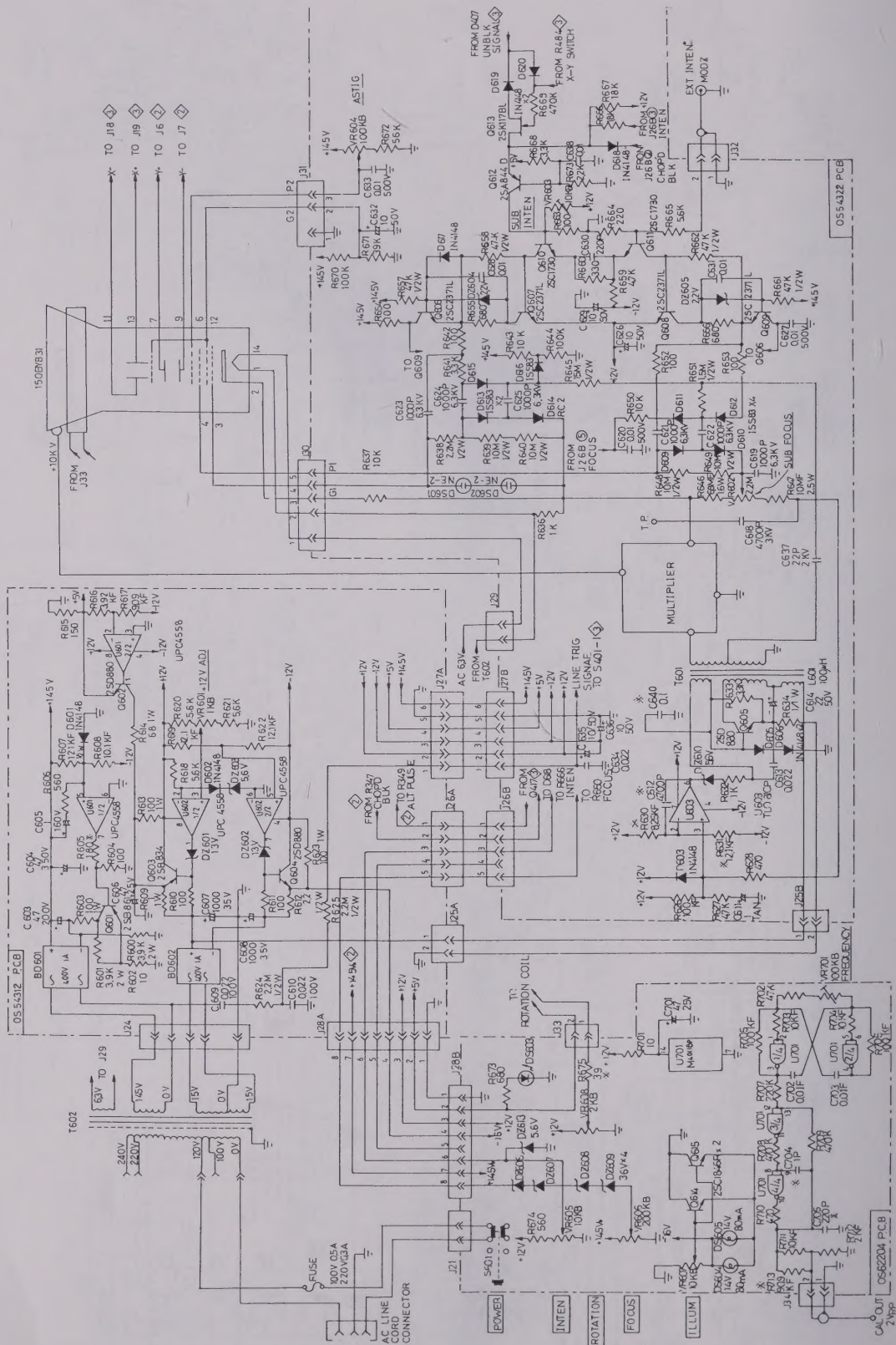
### CAL TERMINAL ADJUSTMENT

1. Set the **VERT MODE** switch to **CH 1**.
2. Set the **CH 1 AC-GND-DC** switch to **DC**. Set the **CH 1 VOLTS/DIV** switch to **0.5 V**.
3. Set the **TIME/DIV** switch to **0.1 mS**.
4. Using a coaxial cable, connect the **CAL** signal output to the **CH 1** input terminal.
5. Adjust VR701 (1 kHz CAL) for a one-cycle Square-wave waveform aligned with the ten division graticule lines.









## NOTES



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